SCIENCE

FRIDAY, FEBRUARY 10, 1888.

THE ANNUAL REPORT of the New York State Department of Public Instruction has been laid before the Legislature by Superintendent Draper. It contains some very interesting statistics and observations. It appears that the department expended during the year, $14,461,774.94, and this sum does not include the payment to Cornell University, the expenses of the regents, or the appropriations to academies; so that even this enormous sum does not fully represent the State expenditure for common schools. Over 31,000 teachers were employed, and only 5,821 of them were males. The average annual salary of a teacher is, in the cities, $687.12; in the towns, $262.44. The number of children of school age was 1,763,115, and the total enrolment was 1,037,812. The average attendance was only 625,610. The superintendent points out that the uneducated class is increasing, and that the attendance in the schools does not keep pace with the growth of the population. The shortcomings of the present compulsory Education Act are pointed out, and some excellent suggestions are offered as to the best way to remedy the difficulty. On the subject of manual training, Mr. Draper seems to be conservative, but still open-minded, and ready to recommend whatever is proven to be desirable. He says, "There has been much discussion during the year relative to the introduction of manual training as a regular branch of public-school work; and several cities, notably New York and Albany, have undertaken a thorough trial of the experiment. It is much to be hoped that it may prove a wise undertaking. There will hardly be two opinions as to the advantages of industrial training, but it must be demonstrated, upon actual trial, that it can be made a part of our common-school work with advantage to pupils, without detracting from the old-fashioned and essential work, . . . before it should be generally taken in hand by the school authorities. The experiments which have been entered upon will be watched with much interest. The test will be a severe one, but it must be met successfully, by a trial in good faith, before the already overfull courses of study in the schools should everywhere be opened to admit what is commonly called industrial training. There is a common misapprehension in this connection. Manual training need not be confined to carpentry work with boys, or making aprons and dresses with girls. Free-hand or industrial drawing may train the hand and the eye more effectually than handling a saw or a needle. It is easily taught, it is inexpensive, and it is practicable. It is the best possible preparation for further manual work. Every school in the State may undertake this without difficulty, and with good promise of excellent results, and then safely wait for the verdict of those who are further experimenting upon the subject. . . . The mission of the public schools is to best prepare the greatest possible number of children for the activities of life, for social and industrial relations, and for the responsibilities of citizenship under such a government as ours. The few must not be favored at the expense of the many. The beginners must have the most care and the best work. What is done must be practical. A philosophy is of small use unless it materializes. Children must be evenly educated in all directions. Just what shall be taught in detail, must depend upon what, in a practical way, promotes the end for which the schools are maintained at public and general expense." After a survey of the field of educational work, Mr. Draper is able to express a favorable judgment on what is being done, and concludes thus: "There seems to be unmistakable promise of an educational re-organization and revival in this State. Public occurrences during the year have forced the subject upon the attention of the people. Our supervisory officers and teachers are coming more and more to realize the importance, as they are striving more and more earnestly to accomplish the organization of a comprehensive, symmetrical, and harmonious State educational system, in which the district schools, the union schools, the high schools, the academies, the normal schools, and the colleges and universities, shall have their appropriate place, and shall not rival or antagonize, but arrange their courses of instruction so as to support and supplement each other, and work intelligently together for a common and beneficent purpose. The fact must be hailed with universal and unfeigned satisfaction among all our people. The promise must become a realization, if our magnificent commonwealth would maintain her foremost position in the sisterhood of States."

THE DEATH PENALTY.

IT will be remembered that the Legislature of the State of New York in 1886 passed an act providing for the appointment of a commission "to investigate and report at an early date the most humane and practical method known to modern science of carrying into effect the sentence of death in capital cases." The commission, consisting of Elbridge T. Gerry, Matthew Hale, and Alfred P. Southwick, has just made its report to the Legislature. Immediately after its appointment, the commission met, and carefully considered the general outlines of the subject, and also examined the entire criminal law, from its earliest history down to the present time, as to the principles upon which the infliction of capital punishment was based, the methods of execution and the reasons therefor; and in its report, which consists of a pamphlet of one hundred pages, it gives a history of the law, beginning with that of Moses. Letters were sent to sheriffs, physicians, and judges, requesting their opinions as to the present modes of punishment, and inviting suggestions. To these letters two hundred answers were received, and, after their perusal and a careful study, the commission decided that electricity was the best means for effecting capital punishment.

The advantages claimed for electricity are, that death is instantaneous upon its application, and that resuscitation is impossible. For the administration of electricity to a criminal, all that would be essential would be a chair with a head and foot rest, in which the condemned could be seated in a semi-reclining position. One electrode would be connected with the head-rest, and the other with the foot-rest, which would consist of a metal plate. The expense of such a chair would not exceed fifty dollars. If the current of electricity is supplied from the electric-light wires, there would be but slight expense incurred to make the connection from the chair with the wires on the outside. An independent application would cost between two hundred and fifty and five hundred dollars.

The commission concludes its report with the following recommendations: that the death penalty must be inflicted by causing to pass through the body of the convict a current of electricity of sufficient intensity to cause death, and the application of the current must be continued until the convict is dead. The execution must take place within the walls of the State prison designated in the warrant, or within the yard or enclosure adjoining. It shall be the duty of the warden to be present at the execution, and to invite the presence of a justice of the Supreme Court, the district attorney, and sheriff of the county in which the conviction was had, together with two physicians and twelve reputable citizens. Besides one, or, at most, two clergymen, and seven assistants or deputy-sheriffs, no persons other than those mentioned shall be permitted to be present. Immediately after the execution, a post-mortem examination of the body of the convict shall be made by the physicians

present at the execution, and their report in writing, stating the nature of the examination made by them, shall be annexed to the certificate, signed by all the persons witnessing the execution, that the sentence was duly carried into effect in accordance with the requirements of the law. After the post-mortem examination, the body shall be delivered by the warden, for the purposes of dissection, to some public hospital or incorporated medical college within the State; or the body may be interred in the graveyard or cemetery attached to the prison, with a sufficient quantity of quicklime to promptly consume it. In no case shall the remains be delivered to any relative or friend; and no account of the details of any such execution, beyond the statement of the fact that the convict was, on the day in question, duly executed according to law at the prison, shall be published in any newspaper.

EXPLORATIONS IN THE DOMINION OF CANADA, 1886.

THE government of the Dominion of Canada, as well as those of the several provinces, are actively engaged in explorations and surveys, and a large amount of material is continuously being added to our knowledge of British North America. In the year 1886 work was in progress in all parts of the Dominion.

In British Columbia Mr. A. Bowman continued his explorations in the Cariboo district. He left Victoria on the 23d of June, accompanied by Mr. James McEvoy as geographical assistant, and on July 3 the party was ready to start into the field. While in 1885 the roads and trails were measured, and the centrally situated mountains were occupied as triangulation stations, geological researches being subordinate to geography, in 1886 great attention was paid to geology. The Goose Creek Mountains and the Selkirk Range, where there are no trails, were traversed with shoulder-packs, relying on the rifle to a considerable extent for supplies. A micrometer measurement of the great Quesnel Lake was carried out, with the aid of a large Chinese boat and an Indian canoe. Bear and Swamp River Mountains and the Dragon Creek Mountains were ascended with a single pack-horse, relying on the axe for progress, instead of a trail. The geographical work was completed by occupying with the transit all the necessary outlying stations, and by measuring with the steel tape two independent base-lines, which will be used as the foundation of the whole of the work.

Farther east, in the Rocky Mountains, Mr. R. G. McConnell has continued previous work in the vicinity of the Canadian Pacific Railway. Work was commenced on the 24th of May, at the gap of the Bow River, and during the course of the summer all the subordinate ranges lying between that point and Gold City were ascended and examined. Although the work was principally geological, our knowledge of the topography of the region was considerably increased, a number of sketches and cross-bearings having been taken from the summits of most of the mountains ascended.

In the district between the Bow and the North Saskatchewan Rivers, J. O. Tyrrell and D. B. Dowling were exploring. Here geology was also the prime object of the expedition; but incidentally the limits of prairie and wooded country in that district have been determined, and careful barometric readings have been taken at numerous points throughout the area examined, in order to lay down on the map approximate contour-lines.

A. C. Lawson continued his researches on the country east of the Lake of the Woods, principally mapping Rainy Lake and the adjacent territory. The main achievement of the season of 1886 was the connection of the township surveys on Rainy River by way of the Manitou canoe route with the Canadian Pacific Railway, and of the canoe route from Lake of the Woods to Rainy Lake.

Of great importance is A. P. Low's and J. M. Macoun's survey of Berens River and Deer Lake. On the 28th of May the mouth of Berens River, on Lake Winnipeg, was reached. Here, having purchased canoes, the season's work was commenced. From its mouth the Berens River was found to trend for one hundred and two miles south of east to Family Lake. Throughout this distance its course is broken by numerous small falls. At Family Lake the river bends sharply to the north, and the survey line runs in a slightly north-of-east direction to the height of land, passing through several lakes. Here the party reached Severn River by a short portage, and followed the stream in a north-east course. On the 19th of June, Deer Lake, which was in part surveyed by Cochrane in 1882, was reached. Descending its outlet for one hundred and seventy-five miles, another large lake was reached, the shores of which were covered with a fair growth of timber. This is called Favorable Lake. Following the river, running out of it for one hundred miles, a larger lake, called Sandy Lake, was entered. After one hundred and fifty miles more, Severn Lake was reached, whence the party proceeded to the Hudson Bay post on Trout Lake, and down Fawn and Severn Rivers to Fort Severn on Hudson Bay. The party then proceeded along the coast to York Factory, and returned, ascending the Hayes River route, to Norway House.

Another extensive journey was accomplished by Dr. Robert Bell. After a brief visit to Manitoulin Island, he went to Sault Ste. Marie, where he hired six *voyageurs* for his northern exploration. These, and the outfit of the expedition, were conveyed to Wabigoon Tank, on the Canadian Pacific Railway, and hence transported over a portage to Sandy Lake, from which the expedition was to start. Leaving the portage on the 6th of July, the general course of the route was north-eastward towards Cape Henrietta Maria, on Hudson Bay. The party first proceeded to Lonely Lake by way of Minnetakie Lake and its outlet. Having descended the upper part of the Albany River, Bell crossed the country northward to the Attawapishkat River, which he descended to the sea. Then he coasted southward on the west side of James Bay until the Albany River was reached. He ascended this river, and its tributary the Kenogamin River, to its source, whence he reached the Canadian Pacific Railway. The whole course from Long Lake to the junction of Albany and Kenogamin Rivers, with the exception of the coast of James Bay, was surveyed. The distances were ascertained by a boat's log, or by the time occupied in traversing them at a known speed, while the bearings were taken by compass. Observations for latitude were made almost every day, and the variation of the compass was also frequently ascertained.

The following part of Dr. Bell's description of his journey is of general interest, as it contains much new information: —

"On arriving at the Attawapishkat, I left my stores and large canoe in charge of one man on an island which I called Nolin's Island, and proceeded with the other men to examine the upward course of the larger stream for some distance previous to descending it to the sea. At about eleven miles above Nolin's Island we reached the lowermost lake of the Attawapishkat, which, the Indians informed me, bears the same name as the river itself. It lies diagonally across the course of the river, and has a length of about nine miles from south-west to north-east by four miles from south-east to north-west. Two miles above Attawapishkat Lake we entered a beautiful lake of much larger size, which, having as yet no distinctive name, I propose to call Lake Lansdowne, in honor of the governor-general of the Dominion. This lake proved to measure about thirteen miles from south-east to north-west by about ten miles from south-west to north-east, and it is the largest sheet of water connected with the river. It contains many large islands, and is much indented with bays. The surrounding country is more or less undulating and hilly, and thus affords a pleasing contrast to the level and monotonous character of nearly all the rest of the region explored during the season. The commencement of the upward continuation of the Attawapishkat River is found in the south-western bay of Lake Lansdowne. This part of the river is described by the Indians as being broad, having, for the most part, a sluggish current, and expanding occasionally into small lakes.

"The Attawapishkat River proved to be somewhat smaller than the Albany, which is not far from the size of the Ottawa above the capital. It descends at an almost uniform rate all the way from Lake Lansdowne to the sea, — a distance of several hundreds of miles. In this distance we did not require to make a single portage, and, from the description of the river above the lake, it would appear to be navigable without portages almost to its source, which has probably an elevation of more than one thousand feet above the sea. Where it flows over the limestone country it is broader and shallower than in the higher parts of its course.

"The seacoast between the Attawapishkat and Albany Rivers is very low and uniform in outline, and without indentations. The water is so shallow that we could touch the bottom with our canoe-

paddles at from half a mile to one mile from the shore. In order to pass the bowldery reefs, which extend from the shore north of the Albany, we were obliged to go so far out from the land that the tops of the trees were barely visible at the highest places.

"A careful track-survey of the Albany was made from its mouth to The Forks, which, with that of the upper part, also made during this season, when plotted, will enable me to map the whole course of this river, an actual survey of the intermediate portion having been made by myself in 1870. This river possesses additional importance from the fact of its constituting part of the northern boundary of the Province of Ontario."

Dr. Bell's assistants, Messrs. Macmillan and Murray, made a track-survey of part of the Albany River, leaving Bell's party at the lowest point reached by him on the Albany River.

E. Coste completed, with the assistance of J. White, a map of the Madoc and Marmora region, Ontario. We can only mention the surveys of R. W. Ells in the Eastern Townships, near the boundary of Maine, and L. W. Bailey's and R. Chalmers's work in New Brunswick.

Of no less importance are the surveys of the technical branch of the Department of the Interior, under the direction of the surveyor-general, Capt. E. Deville. A number of surveys were made near the Canadian Pacific Railway. Otto J. Klotz was put in charge of the survey of the Canadian Pacific Railway from the summit of the Rocky Mountains to Revelstoke on the Columbia River. In his report will be found an interesting table of elevations of mountain-peaks and a description of the country adjacent to that part of the railway. William Ogilvie was engaged in astronomical observations for determining the longitude of Kamloops. J. J. McArthur made an important topographical survey of those regions adjacent to the Pacific Railway which were not explored by Dr. G. M. Dawson on his reconnaissances of the Rocky Mountains. Fred. W. Wilkins was put in charge of an exploratory survey of Lake Winnipeg, of which he made a complete circuit. He gives the length of the lake as two hundred and seventy miles, its width ranging from two to sixty miles. He describes the lake as shallow, rough, and stormy, and navigation as extremely difficult and dangerous. The east coast is studded with reefs, rocks, and rocky shoals. The west coast, though having deep water in some places, is also very shallow, but its coasts are sandy and muddy. Besides this, numerous township and road surveys were made.

In 1885 the country adjacent to the Banff Hot Springs on the Pacific Railway was reserved for public use, and during the last year it has been surveyed, and roads are constructing which will make accessible the numerous sights of this Canadian National Park. In addition to the reservations at Banff, four mountain parks were reserved in 1886, — Mount Stephen and its environment, Mount Sir Donald, taking in the famous loop of the railway, Eagle Pass, and the amphitheatre at the summit of the Selkirk Mountains.

The Department of Marine was not less active in exploring the little-known parts of the Dominion. We reported on the third Hudson Bay expedition, under Lieut. A. Gordon, in No. 252 of *Science*. Commander J. G. Boulton was actively engaged in carrying on his surveys in Georgian Bay and North Channel, the results of which are published in charts of the British Admiralty, and in the 'Georgian Bay and North Channel Pilot,' which contains much interesting information on those waters.

The Indian Department was engaged in surveying and laying out reserves for various tribes, but principally for those of British Columbia; and the descriptions of the reserve commissioners are of some interest.

The provincial government were busily engaged in extending the surveys of the crown lands. The reports and descriptions of the provincial land surveyors abound with information on the townships they surveyed and divided, and we can only point out a few of the more important reconnaissances of outlying regions. In the Province of Ontario, A. Niven surveyed the outlines of seven townships adjacent to Lake Temiscamingue, in the Nipissing district. He found nearly the whole of the outline to be good farming land, the country level and free from stone. Another reconnaissance was made between Rainy Lake and the 49th parallel, from which it appears that most of the country is rough and broken, with occasional valleys of good land.

In the Province of Quebec, W. A. Ashe made a survey of the Temiscamingue region, and his report on this country agrees with that of A. Niven, who surveyed those parts belonging to Ontario. C. E. Forgues visited the numerous streams emptying on the northern coast of the Gulf of St. Lawrence, and found that they yield a considerable amount of salmon.

The exploration and colonization of the outlying districts, which were considered of no value whatever a short time ago, are progressing rapidly. Railways and colonization roads are being built and pushed forward in all parts of the country, and the newly opened districts becoming rapidly settled.

As our knowledge of Canada makes rapid progress, so the science of geography has been gaining many friends, and geographical problems are discussed by many societies. It is the subject of many papers read before the Royal Society of Canada; and among them, Capt. E. Deville's paper on the best projection for maps of the Dominion of Canada takes a prominent place. The Geographical Society of Quebec publishes in its Transactions a considerable amount of interesting information, and the associations of the Dominion Land Surveyors and those of the Provincial Land Surveyors of Ontario discuss many matters of geographical interest in their annual reports. DR. F. BOAS.

MENTAL SCIENCE.

What the Will Effects.

UNDER this head Professor James (*Scribner's Magazine*, February, 1888) discusses the processes of voluntary action from the point of view of the 'new psychology.' The discussion is in so many respects characteristic of the rejuvenating interest with which this point of view invests the topics that have always occupied the thoughts of reflecting people, that a somewhat full account of the article will be given below, in the hope of inducing those interested in this science to read the original.

The point of advance in the 'new psychology' of the will that Professor James regards as of most value is its reference of all activity to the type of reflex action. The steps between the application of the stimulus and the accomplishment of the re-action may be short and simple, or they may be long and intricate. I may wink instantaneously at a threatened blow, or I may take a long time in deliberating how to act upon the receipt of a momentous letter. In either case the psychic process, which in the most highly developed form becomes conscious thought, is regarded as a means towards an end, — the action, the conduct. Life is an adjustment to the environment, and the new environment is ever developing in complexity and variability of the adjustments that it makes necessary. A certain kind of these adjustments are usually singled out for separate treatment under the term 'voluntary actions;' but the doctrine now generally accepted is that this class of acts has been evolved from the involuntary acts. The distinction is one of degree of complexity and other characteristics, important among which is the characteristic that in the voluntary action the act is foreseen, the idea precedes its execution, while in the involuntary mode of action the act, though perhaps foreseen as a result of remembered experience, takes place not in obedience to this foresight, but "we know what we are going to do only after we have done it." From this it follows that no act can be voluntary the first time it is performed. "Until we have done it at least once, we can have no idea of what sort of a thing it is like, and do not know in what direction to set our will to bring it about." If one attempts to move his ear, the great difficulty is to know what sort of an effort to make, and what is lacking is the remembrance of the feeling of a moving ear. This is the mental material out of which the motion is generated, and the way to proceed is to move the ear passively until we have a tolerably clear idea of the feeling of the ear when it moves, and then attempt to reproduce this feeling. We teach children to write by holding their hands in the proper position, until they know how it feels; and so, in general, unless we have a guide to direct us in the kind of effort we ought to make to secure the desired end, we must more or less trust to a chance success. There is no abstract willing into the void, and without a memory there could be no will. All our most elaborate acts of will depend for their execution on certain physiological co-ordinations, which, in

turn, have been evolved in one way or another from the instinctive expressions of our automatic life.

This idea of the intended action is not only necessary for the will: it is a sufficient incentive to it. The class of action to which Carpenter gave the name 'ideo-motor' is really the type of action. To this class belong such movements as those concerned in picking a pin from the floor while talking, or in scribbling with a pencil, or absent-mindedly taking nuts and raisins from the dish during an after-dinner chat. The deliberate eating is over, but the idea of eating as excited by the sight of the dish, "not meeting with any express contradiction, fatally passes over into action." It needs for this no separate *fiat* of the will: it is enough that no positively hindering idea should be there. The familiar dialogue of ideas that takes place when we have the ordeal of rising on a cold morning before us, illustrates the mental process admirably. We think how late it is getting, how much we have to do, how shameful it is to waste time in this fashion, and yet we remain passive and comfortable, allowing the resolution to fade away every time it seems about to pass into effect. How do we ever get up in such a case? "We suddenly find that we have got up. A fortunate lapse of consciousness occurs: we forget both the warmth and the cold; we fall into some revery connected with the day's life, in the course of which the idea flashes across us, 'Halloo! I must lie here no longer,'— an idea which at that lucky instant awakens no contradictory or paralyzing suggestions, and consequently produces immediately its appropriate motor effects." In general, "the sole known cause for the execution of a movement is the bare idea of the movement's execution, and, if the idea occurs to a mind empty of other ideas, the movement will fatally and infallibly take place." The hypnotic subject well illustrates this principle, for it is just because his mind is empty of other ideas that he acts out so promptly and automatically any and every suggestion of the hypnotizer. Normally the mind is full of a host of ideas, and, if they harmonize with the idea that is to lead to action, they will re-enforce and quicken the act: if they conflict with it, they delay it or may prevent its realization altogether. Had we simply called up the idea, 'we have eaten enough,' this would have been sufficient to check the raising of the hand towards the confectionery on the table. This fact of one brain-process interfering with another, physiology terms 'inhibition,' and sees in it no more (and also no less) a mystery than in the fact of stimulation itself. The reason, then, why, with a constant stream of thought passing through one's mind from morning till night, there are so few that lead to action, is because the various things thought of at once meet with contradictory thoughts, and do not conspire with the action. "They are not consented to. 'Consent,' in short, is a word which describes most of our activity far more accurately than 'volition' does." The volition would quite as often consist in refusing this consent. The lack of power to refuse this consent, to call up the contradictory ideas with sufficient vividness, is what characterizes the slave to passion. The drunkard finds himself preparing to drink at the sight of every bottle and glass, not because he does not realize the consequences of his act, but because he does not refuse his consent to it. "This is why volcanic natures like the Mahomets, the Luthers, and the Bonapartes, are usually fatalists. They find themselves bursting into action with an energy at which they are themselves astonished, as if some god or demon had released a spring."

Having thus considered involuntary actions, and the action following upon the volition of consent, there remains the most highly evolved type of actions, such as depend upon the volition of effort. The 'new psychology' naturally rejects the notion that the will is an outside force exerting its influence upon conduct in a very remote and contra-physical manner, and regards the will as bound down by the conditions of nerve-cell and muscle quite as much as are the simpler acts of a sentient being. The effort does not supplant the ideas: it simply enables us to hold them fast, so that they may become vivid enough to make the physical machine obey. When laboring under a passion, the difficulty in acting rationally is not a physical one. It is as easy, physiologically considered, to perform the movements that lead to the fleeing from temptation as those that yield to it. The difficulty is a mental one. It is the difficulty of getting the idea of the rational conduct to stay before the mind at all. The effect of a strong emotional state is to shut out all ideas that do not harmonize with the satisfaction of the emotion. All others are hushed, and allowed no audience. "The cooling advice which we get from others when the fever-fit is on us is the most jarring and exasperating thing in life." If the rational ideas can ever get a hearing, the crisis is past; for with the new ideas come new tendencies to action, that lead away from passion, and so avert the evil. The strain of the will consists in the keeping the attention fixed on such ideas as the better conscience knows to be warranted, and in keeping down the conflicting notions. "Consent to the idea's undivided presence, — this is the effort's sole achievement: its only function is to get this feeling of consent into the mind." And from this view, it is as good a case of willing if I give my consent to the table's moving as to the movement of my own legs. In the one case the consent is so connected with a nervous system (which connection itself is liable to disturbance by disease), that the act follows from the consent: in the other no such connection exists. In principle the two cases do not differ: the mental prerequisite of the willed action is present.

The moral effort, then, that we have constantly to perform in life, is the overcoming of the resistance which certain ideas offer to being attended to at all. The resistance may be internal, as the uncongeniality of the task; or external, as conflicting with the mood of the mind at the moment: for example, the thought of to-morrow's task while enjoying one's self at an evening's entertainment. We almost involuntarily decide not to think of that, and so frighten the spectre away. But the moral act is the attending to the thought under such circumstances, until it results in action. And the free-will controversy from this point of view resolves itself into the amount of effort that it is possible to put forth in the way of holding an unwelcome idea in the mind.

The answer to the question, 'What happens when we exert our will?' is, according to Professor James, that 'we simply fill our mind with an idea which, but for our effort, would slip away.' This at once opens up a host of ethical considerations which are treated not in the usual manner of omitting the really difficult points and dwelling upon the easy ones, but by manfully facing the real question. A few citations must suffice to suggest the tone of the view which the article upholds. The first lesson drawn from the psychology of the will is that "the will has as much to do with our beliefs and faiths as with our movements. It is, in fact, only in consequence of a faith that our movements themselves ensue. We think of a movement, and say, 'Let it ensue. So far as we are concerned, let it be part of reality.' This is all that our mind can do: physical nature must do the rest." This is the method of attaining a belief: we let our mind fill with it, and drive other thoughts out of the field. Were the problems of life perfectly simple, and the lessons that nature teaches perfectly clear and unambiguous, there would be no great difficulty in selecting a view and adhering to it. "But these ostrich-like attitudes are both of them [i.e., that of the dogmatic spiritualist and the dogmatic materialist] getting harder than ever to maintain." "So long as our mind is assailed in two such different ways, it is quite idle to talk of its being passive and will-less until the objective truths shall have written themselves down. They write down no messages which are both coherent and universal." Look at the men who at the present day feel life on all its sides, and yet who are incapable of volition in intellectual affairs, and imagine that there ought to be some sort of truth with which they can remain in passive equilibrium. Their feelings make them shiver at the materialistic facts, while their loyalty to science makes them dread to be dupes of their feelings. "But the men of will do not let 'I dare not' wait upon 'I would' in any such sorry fashion. They choose their attitude, and know that the facing of its difficulties shall remain a permanent portion of their task." "No more in the theoretic than in the practical sphere do we care for, or go for help to, those who have no head for risks, or sense for living on the perilous edge."

A STUDY OF HYPNOTISM. — In the current number of the *North American Review*, Dr. Gilles de la Tourrette, a pupil of Charcot, gives an account of the views of the several varieties of hypnotic sleep which the French school have developed. While the article gives nothing that is new, it is a convenient and authoritative exposition of the work that has occupied so much of the attention of the workers at the 'Salpétrière.'

HEALTH MATTERS.

THE THERMAL DEATH-POINT OF BACTERIA. — Dr. George M. Sternberg, U.S.A., the well-known bacteriologist, has been for some time experimenting on the thermal death-point of pathogenic micro-organisms. He has published his results in the *American Journal of the Medical Sciences*. All the tests were made with moist heat, ten minutes being the time of exposure to the given temperature. The absence of growth after eight or ten days is regarded by Dr. Sternberg as evidence that the vitality of the test-organism has been destroyed by the temperature to which it was exposed. No attempt has been made to fix the thermal death-point within narrower limits than 2° C., and the lowest temperature is given which has been found, in the experiments made, to destroy all of the organisms in the material subjected to the test. No doubt more extended experiments would result, in some instances, in a reduction of the temperature given as the thermal death-point for a degree or more; but the results as stated are sufficiently accurate for all practical purposes, and permit us to draw some general conclusions: (*a*) the temperature required to destroy the vitality of pathogenic organisms varies for different organisms; (*b*) in the absence of spores, the limits of variation are about 10° C. (18° F.); (*c*) a temperature of 56° C. (132.8° F.) is fatal to the bacillus of anthrax, the bacillus of typhoid-fever, the bacillus of glanders, the spirillum of Asiatic cholera, the erysipelas coccus, to the virus of vaccinia, of rinderpest, of sheep-pox, and probably of several other infectious diseases; (*d*) a temperature of 56° C. (132.8° F.) is fatal to all of the pathogenic and non-pathogenic organisms tested, in the absence of spores (with the single exception of *sarcina lutea*, which, in one experiment, grew after exposure to this temperature); (*e*) a temperature of 100° C. (212° F.) maintained for five minutes destroys the spores of all pathogenic organisms tested; (*f*) it is probable that some of the bacilli which are destroyed by a temperature of 60° C. form endogenous spores, which are also destroyed at this temperature.

THE HERNDON SCARLET-FEVER EPIDEMIC. — During the past year Dr. Klein of England investigated an epidemic of scarlet-fever the origin of which he believed that he could trace to a herd of cows at Herndon. This investigation of Klein demonstrated that the affected animals were suffering from a disease which was communicable to healthy ones, and also to man by inoculation. It was considered to be distinct from cow-pox; and the weight of evidence seemed to indicate that it was scarlet-fever, and that the milk from animals infected with the disease could communicate it to those who drank it. These conclusions of Klein's have been published broadcast throughout the world, and have been generally accepted. Since this report, the agricultural department of the privy council has authorized another expert, Professor Crookshank, to investigate the subject. He has done so, and has made his report. His conclusions differ entirely from those of Klein. He believes that the Herndon disease was not scarlet-fever, but cow-pox; and of course the epidemic, or rather outbreak, of scarlet-fever near London had no connection whatever with the disease which affected the Herndon cows. Which of the two experts is correct, time alone can decide. Dr. Klein is not a novice in investigations of this kind, and is not likely to be led into such a serious error as the report of Crookshank would seem to indicate. Klein saw the affected cows at Herndon; Crookshank did not, and based his opinion solely on the description of the disease as given by Klein and others. The result of the controversy will be watched with interest by the scientific world.

CONTAGIOUSNESS OF LEPROSY. — The question of the contagiousness of leprosy has again been raised by the action of the board of health of Philadelphia in fining a physician one hundred dollars for not having reported two cases of that disease which were under his care. The editor of the *New York Medical Journal*, in commenting on this subject, claims that there is a mass of incontrovertible evidence to be found in medical literature which ought to place its contagiousness beyond question. In the Sandwich Islands the physicians believe strongly in its communicability, and a number of instances are given which confirm this belief. One of these is that of a Belgian priest who lived in the leper settlement for the purpose of nursing and otherwise caring for those who, having the disease, were here isolated. The result is, that the priest himself is now a victim of the disease. The medical attendants of these outcasts will not go near them without having their hands protected by gloves. The editor of the journal quotes the opinions of other writers who agree with him in his views, and refers to the report of the English commission appointed by the Royal College of Physicians in 1867, which holds that leprosy is not contagious. He concludes by saying, "In the face of all this reliable evidence, a reasonable doubt can scarcely be entertained of the contagiousness of leprosy. In its power of contagion, leprosy may well be, as it often has been, compared to syphilis, and, like that disease, it is frequently contracted through sexual intercourse, and is also just as frequently transmitted to the offspring."

EXPLORATION AND TRAVEL.

Stanley's Expedition.

Petermann's Mitteilungen gives a brief review of the events that have taken place in Central Africa since Stanley's departure from the camp at the Yambunga rapids on the Aruvimi. On the 2d of July, Stanley sent news from Mabode, on the Aruvimi, which was brought to Leopoldville by the steamer 'Stanley.' Since the beginning of July the steamer 'Stanley' has made only one trip to the Aruvimi. On the day of her return, Aug. 17, Major Barttelot, who commands the camp at Yambunga, had no news from Stanley. As Tippo-Tip had not sent the promised troops from Stanley Falls, Barttelot was not able to leave his camp and follow Stanley. After a thorough repair of the steamer, the 'Stanley' left Leopoldville on Nov. 15 for Bangala. After her return she will convey Captain van der Velde to Stanley Falls, where he will establish a new station near Tippo-Tip's village. Therefore we may expect to hear of the events on the Upper Kongo towards March.

Unfortunately the King of Uganda has again cut off the connection between Emin Pacha and Zanzibar, and the reason for his hostility is his fear of Stanley's expedition. After the latter had left Zanzibar, the British consul-general had sent a letter to King Mwanga in order to inform him of the object of the expedition. This letter, which reached Uganda in June, fell into the hands of the Arabs, who were hostile to the Europeans who tried to suppress the slave-trade. They presented it to King Mwanga, and read it to him to suit their purpose. They said the letter informed the king of Stanley's intention to attack the kingdom with an army of two thousand men in order to revenge Bishop Hannington's death. The well-known missionary, Rev. Mr. Mackay, tried to disperse the king's suspicion by informing him of the real contents of the letter; but, as he was accused of being himself an ally of Stanley's, he had to leave the country in which he had lived for nine years. On Aug. 2 he arrived at Msalala, on the south shore of the Victoria Nyanza, where the missionary Gordon had a station. The latter, who was agreeable to King Mwanga on account of his relationship to General Gordon, went to Uganda. The king, however, still suspecting Stanley's intentions, made war upon Kabrega, king of Unyoro, who, he feared, would join Stanley in order to gain his independence. The result of this war is not yet known. But in consequence of this war the messengers who were sent to Casati with letters of credit were prevented from reaching him. It will be remembered that two of Tippo-Tip's men were sent in February of last year on this errand. They went from Zanzibar to Tabora, crossed Karagwe, and reached Kasinga, near the Muta Nsige, in the middle of May. They were, however, unable to enter Unyoro, as it was said that Mwanga had attacked the latter with an army of two hundred thousand men. Having staid two months in Kasinga, they returned to Zanzibar, their means having become exhausted.

In December the news was received in Zanzibar that Stanley had reached Wadelai early in September, and that the passage from Mabode to the Nile was extremely difficult. The messenger who carried the report to Zanzibar was not despatched by Stanley, but learned the news from Arabian traders: therefore it is doubtful whether the report is true. The telegraph said some days ago that news had been received by Dr. Schweinfurth in Cairo, but this highly improbable report has been since denied by Schweinfurth himself.

Antarctic Regions. — The British Government has refused the request of the Australian colonies to grant a subsidy to the proposed Antarctic expedition which was to be organized by a joint effort of the Australian colonies in case the British Government should support the undertaking. This decision will probably postpone the resuming of Antarctic exploration for an indefinite time. Although it is not probable that results of great commercial value will be obtained by an expedition of this kind, the scientific objects are so great that this new delay must be greatly regretted.

ELECTRICAL SCIENCE.

Electricity directly from Heat.

Attempts to generate electric currents, by utilizing the fact that magnetic metals lose their magnetic properties when sufficiently heated, have been made for some years. It is only recently, however, that such experiments have been made on a practical scale, and with any promise of ultimate success. When we consider that in the most economical source of electricity, the dynamo-electric machine, we transform the energy of our fuel to the energy of steam under pressure, then through the steam-engine to mechanical work, and finally by the dynamo to the energy of electrical currents, losing energy in each transformation, our ultimate return being perhaps ten per cent of the energy expended; when we add to this the complication and expense of a steam-plant, — it would seem that, even if our means of direct conversion is not so economical as the dynamo, yet if it have any reasonable efficiency, and is simple of construction, it would supplant the older method.

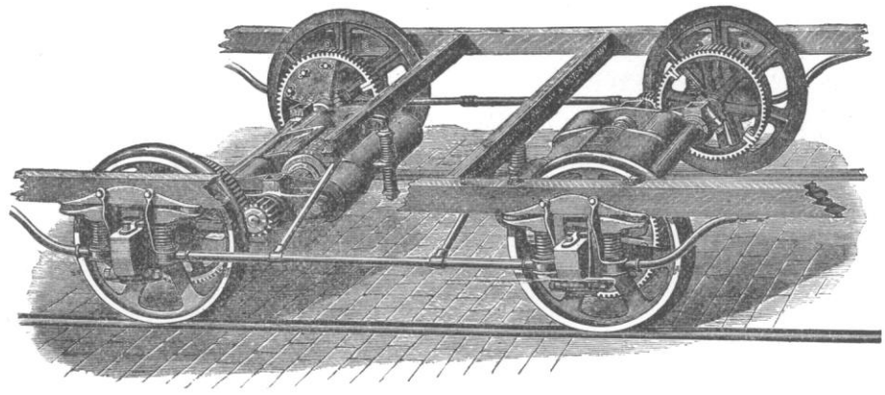
In August of 1887 Mr. Edison read before the American Association for the Advancement of Science a paper on pyromagnetic generators. Briefly the principle on which his machine was built is this. If a piece of iron wrapped with wire be put between the poles of a magnet, a number of lines of force will pass through it, and therefore through the coils of the wire, depending directly on the strength of the magnet and on the magnetic permeability of the iron. Now, it is well known that the permeability of iron becomes very nearly zero when it is raised to a bright red heat: so, if we heat the iron, the lines of force through it will decrease, and this decrease will cause an electro-motive force in the coil of wire. When the iron cools, there will be an increase of lines of force, causing an electro-motive force in the opposite direction. Mr. Edison's machine, built on this principle, consists of eight horse-shoe magnets arranged in a circle, the poles facing inward; and between the poles of each is a roll of thin laminated iron covered with asbestos and wrapped with wire: we will call these the armatures. This is placed over a furnace, and beneath it revolves a half-circle of fire-clay, which shields half of the armatures from the heat. If this shield be turned continuously, half of the armatures are being heated while the other half are being cooled; and the electro-motive forces in the two halves, which would be in opposite directions, are added by a commutating arrangement on the shaft of the shield. A blast of cold air assists the cooling of the armatures.

In his paper, Mr. Edison gave no data as to the performance of the machine, except the statement that a generator to feed thirty incandescent lamps would weigh two or three tons.

Nothing has been heard lately of this generator: it will naturally take time to perfect it and make it practical.

Within the last month, however, attention has been called to a machine using the same general principle as that of Mr. Edison, but differing greatly in detail, — an invention of M. Menges of the Hague.

One form consists of a Gramme ring within which is a stationary electro-magnet. The two are horizontal, and are separated by a considerable air-space: this space is filled by a zigzag ribbon of iron extending around the inner circumference of the ring, with which it revolves. Now, if this ribbon of iron be cold, most of the lines of force will pass through it from one pole to the other of the magnet: few will go through the armature. If, however, the ribbon be heated at points at right angles to the poles, the magnetic resistance will be increased, and most of the lines of force will pass through the armature: there will be no motion, since every thing is perfectly symmetrical. If, now, the heat be applied to the ends of the same diameter at points forty-five degrees from the pole, the symmetry disappears, and there will be a rotation. Now, the Gramme ring rotating in a field of force will generate currents as in an ordinary dynamo-electric machine. In reality, then, we have a motor-dynamo arrangement, the former transforming the energy of heat into motion, the latter transforming the energy of motion into electrical energy.



THE SPRAGUE STREET-CAR ELECTRIC MOTOR.

Both the 'pyromagnetic generators' of Mr. Edison and M. Menges are an advance on previous machines of this type. It is difficult to see, however, how, in their present form, either can produce any very considerable quantity of electrical energy, with any reasonable size of apparatus. The publication of reliable figures on the performance of these machines would be of great interest.

Sprague Electric Railway in Richmond. — There was opened for traffic on Feb. 2 an electric street-railroad that from the extent of the plant, the difficulties overcome, and the perfection of equipment, marks a decided advance in electric traction. The Union Passenger Railway system in Richmond extends from the eastern to the western part of the town, having a total length of track of eleven miles. The road has many curves of short radius. There are grades that reach ten per cent, while there are combinations of curves and grades even more difficult than the steepest of the grades. In one case there is a thirty-foot curve on an ascent of seven per cent. In addition to this, but a small part of the length is through paved streets, and in wet weather the mud is so bad that in some places it completely covers the rails. The road is equipped with forty large sixteen-foot cars. Beneath each car are two 7½-horse power motors, one geared to each pair of wheels. The current is taken from an overhead wire by a wheel or trolley of sheet brass fixed on the end of a rod which holds it up underneath of and in contact with the wire. This rod is fixed on trunnions, and is fitted with springs that give a gentle pressure at the contact. The motors, nominally 7½-horse power each, are capable of developing over ten-horse power when necessary. They

are beneath the car, out of sight, and are geared by a system of spur-gears to the axle of the car-wheels. Each motor is swung in a cradle one end of which pivots on the car-axle, — the axle passing through bearings in the cradle, — while the other end is fastened to the car-frames by heavy spiral springs above and below. These springs are for the purpose of avoiding any sudden strains. Between the gear on the motor shaft and that on the car-axle is an intermediate gearing which is fitted on its axle with rubber cushions to give additional relief from shocks. The whole gear system works easily, and makes very little noise. The switches for controlling the current are on both platforms, the car running in either direction. The coils of the field-magnets of the motors are divided into a number of sections, and the switch makes different arrangements of these coils, putting them all in series (when the current is least) or in parallel (when the current is greatest), or using different combinations for intermediate powers. The cars are under perfect control: they start easily, and can be backed instantly in case of emergency. Brakes are used both for the wheels and on the track, the ordinary wheel-brake not being sufficient for some of the steep grades that occur. Power is supplied from a central station in about the middle of the line. There are six dynamos, giving 500 volts and 80 ampères each. The line was opened for traffic with ten cars running. They were crowded with passengers during the day; and the heavy travel, together with the inexperience of the drivers, was a severe test for the system. There were a few small troubles, but these were soon rectified; and, on the whole, the day's work seemed to prove the system a success.

BOOK-REVIEWS.

Political Economy. By FRANCIS A. WALKER. 2d ed. New York, Holt. 8°.

IT would be superfluous to commend to American readers any economic writing by President Walker. His clear style, vigorous thought, and terse expression have long since placed him in the front rank of economic thinkers, whether American or European. His wide experience and his philosophic insight raise him far above those scribblers of ephemeral pamphlets who are crying now for socialism, now for co-operation, now for *laissez faire*, and all under the name of 'political economy.' President Walker sees very clearly that economics, if it is a science at all, is only to be studied in the ever-varying phenomena of human nature, and he would be the last to attempt to regulate or produce either character or productivity by statute.

The present volume is the best adapted to the present needs of students in the United States, of any that have come from the press. Not only are the general topics of political economy treated fully and with ample illustration, but a concluding part (and a generous one) is given to the discussion of present problems under the head of 'Some Applications of Economic Principles.' We do not follow President Walker in his virtual indorsement of the Ricardian theory of rent, or of Malthusianism; for, despite what he says, both doctrines appear to us to be mere approximations, and not certainties. It is the assumption of their certainty, and the basing of elaborate deductions upon them, which have made so many of the theoretical conclusions of political economy so absurdly at variance with facts. On the wages question President Walker is particularly strong and clear, and his conclusions incontestable. It is interesting to see a professed economist write of the system of protection as the author does. His fellow-economists are given to abuse and the hurling of epithets as soon as the subject is mentioned; but President Walker, in a fairer spirit, writes, "If the protectionist can show that restraints imposed by law upon the industrial action of his countrymen, or the men of any country he chooses to take for the purposes of the debate, have the effect not, indeed, to generate productive force, but to direct the productive force generated by human wants, setting in motion labor with a better actual result than under the rule of freedom, he will make his case. But this is to be proved, not taken for granted; and it is only to be proved by sound and serious argument, not by strenuous exertion and senseless clamor" (pp. 508, 509). This is a position which all rational men can accept; and it is infinitely removed from the line of argument, or rather of invective, pursued by Professors Sumner and Perry. President Walker's argument in Paragraph 615, we do not, however, quite understand; for it seems to imply that the advocates of protection insist on that as a universal fiscal policy with a view to making industrial entities correspond to political ones. As we read their arguments, on the other hand, no such claim is made. It is only asserted that protection is best for the United States at this time. At all events, a free-trade argument on the basis indicated by the writer would be both valuable and interesting.

We cannot refrain from expressing the wish that this book may find its way into more of our colleges, for it is worthy of them.

Nuttall's Standard Dictionary of the English Language. New edition, revised by Rev. James Wood. New York, Warne & Co. 8°. $1.50.

GREAT improvements have been made of late years in concise and handy dictionaries. Those formerly in use contained but a small proportion of the words in the language, and many of the definitions were nothing but synonymous terms; so that, for every purpose of real scholarship, reference had to be made to a large dictionary. But now we have several dictionaries of convenient size and low price, which really serve their intended purpose, and one of the best of these is that now before us. We have not examined the work in detail; but such examination as we have been able to give it shows it to be worthy of the popularity it has already attained. The definitions — always the main point in a dictionary — are up to the level of those in other English dictionaries, and the various meanings of the same word are distinguished with much fulness and accuracy. Illustrative examples from authors are not given, as the smallness of the book forbids it; but there are some pictorial illustrations, though not so many as in some other dictionaries of a similar character. The orthography is that usually employed in England, including the *u* in such words as 'honour.' The pronunciation is indicated by respelling, with only a slight use of diacritical marks, — a method which, for young people and for many older ones, has certain advantages. The present revised edition contains many new words of science and literature, and indicates in a brief way the derivation of the more important words when this is not obvious. At the end of the volume are the usual vocabularies of proper names, and a brief list of proverbs and quotations from foreign languages, with their meaning in English. The type employed in the book is necessarily small, though not so small as in some other concise dictionaries, and it is new and clear. The book is a medium octavo of eight hundred pages, and will be useful to all who wish for a dictionary of this character.

Hand-Book of Volapük. By CHARLES E. SPRAGUE. New York, The Office Co. 12°. $2.

Volapük. By KLAS AUGUST LINDERFELT. Milwaukee, Casper. 16°. 50 cents.

THE bibliography of Volapük now comprises about a hundred books, but, probably for reasons well presented by Professor Bell in *Science* of Jan. 27, very few of these works are in English. The above are two out of the first half-dozen books on the subject in the English language, though many periodicals in this country have given considerable space, especially during the past few months, to Volapükian literature. Mr. Sprague, who appears to be at the head of the movement in this country, gives, in the introduction to his hand-book, a brief history of the new language and of its rapid progress in Europe. He states that it was invented and first published in 1879 by Johann Martin Schleyer, a German priest, whose object was, "first, to produce a language capable of expressing thought with the greatest clearness and accuracy; second, to make its acquisition as easy as possible to the greatest number." He sought to accomplish these ends "by observing the processes of the many languages with which he was acquainted; following them as models wherever they were clear, accurate, and simple, but avoiding their faults, obscurities, and difficulties." The result of his labors is a language whose "rules have the advantage of being absolute, and unburdened with exceptions," as Professor Bell puts it. A clear and attractive exposition of the new language, in small compass, is given by Mr. Sprague, who modestly claims that the most obvious application of it, in the immediate future at least, is for international correspondence, especially commercial correspond-

ence, which is numerically most important. Mr. Linderfelt's little volume presents the subject in an equally attractive though somewhat different manner, being based upon a German work by Professor Kirchhoff of the University of Halle. Each book contains a copious vocabulary, besides exercises in reading and translation.

Management of Accumulators. By Sir DAVID SALOMONS. 3d ed. New York, Van Nostrand. 16°.

IN the last few years it has been recognized that the treatment of secondary batteries has as much to do with their life and economy as the method of manufacture, especially in the 'grid' type of cell now generally used. No one has had more experience in the use of storage cells than Sir D. Salomons, and what he tells us is of great value to those who work with them.

The present edition of the 'Management of Accumulators' is much larger than the two previous editions, the principal increase being in the chapters on installation. The book is in no sense a treatise on accumulators: it gives but a bare and incomplete description of the chemical actions that take place, and does not attempt to describe any form of battery other than the grid type of the E. R. S. Company's pattern. Instead of this, it gives explicit directions for the care of batteries and the installation of an isolated lighting plant, and it gives estimates of the cost of installation under various conditions. The least satisfactory chapter — that on engines, dynamos, and electric motors — fortunately is the easiest dispensed with.

This book will be valuable to all those who have to do with storage batteries: it will possibly be out of date in a couple of years. The storage battery is being constantly changed and developed, but in the mean time it will have done a good work, and it is to be hoped, that, when the practice changes, Sir David will write a new book.

NOTES AND NEWS.

THE annual winter meeting of the Department of Superintendence of the National Educational Association was held in the hall of the Franklin School, Washington, D.C., on Tuesday, Wednesday, and Thursday of this week. An excellent programme had been prepared by President Dougherty, and the number of distinguished educators who delivered addresses was unusually large. The most important topics treated were, 'How and to What Extent can Manual Training be ingrafted on our System of Public Schools?' by Charles H. Ham of Chicago, Superintendent MacAlister of Philadelphia, Superintendent Marble of Worcester, President Nicholas Murray Butler of New York, Superintendent Powell of Washington, and Dr. Belfield of Chicago; 'How can the Qualifications of Teachers be determined?' by State Superintendents Draper of New York, Higbee of Pennsylvania, Finger of North Carolina, Kiehle of Minnesota, Easton of Louisiana. President Eliot of Harvard read a paper on the second day of the meeting.

— The October number of the *Monthly Weather Review* contains an interesting discussion by E. B. Garriott on the movements of high-barometer areas over the North Atlantic Ocean, founded on the daily weather-charts for 1885. In the *Weather Review* for July, 1887, it was shown that a cyclone's movement depends upon its position with reference to anticyclonic areas, and that during periods of high barometric pressure over mid-ocean north of the 40th parallel, storm areas do not follow the usual east-north-east course to European waters, but pursue a more northerly track, or disperse. In order to study the course of cyclones more closely than has been done heretofore, this investigation was carried on, and resulted in the discovery of the following facts. There exists almost continually an area of high barometric pressure south of the 40th parallel, and one of low barometric pressure farther north. Upon advancing from the American coast, areas of low barometer appear to move towards the region of low barometer, and areas of high pressure are apparently attracted to the region of maxima. The latter show a far greater degree of uniformity of movement than the cyclonic areas, their course and velocity being seldom influenced by the cyclonic areas that may precede or follow them. About ninety per cent of these anticyclones pursue a south-of-east course from the American coast, and, upon advancing to the vicinity of the 60th meridian, lose their individuality and become a part of the great anticyclonic system of that region. The average time occupied by the anticyclones of 1885 in advancing from the 90th meridian to the coast was about one and one-half days, this rate of progression being considerably greater than the average velocity of cyclonic areas over that region. As soon as an anticyclone is absorbed by the great anticyclonic system, the latter extends considerably westward, and therefore a cyclone closely following the passage of a high-barometer area takes an abnormal northerly course; and, on the other hand, the greater the period which exists between the advance of the areas from the coast-line, the greater will be the likelihood of the low-pressure area pursuing a normal path over the ocean. As in the normal movement of cyclonic and anticyclonic areas the latter more frequently closely follow and accelerate the forward motion of the former upon passing from the coast, they materially contribute to the greater rapidity of their advance over the ocean. The thorough study of the normal movements of anticyclonic areas over the continent and the western portion of the ocean, and of the relations which exist between high and low barometer areas attending their passage from the coast, will probably enable us to determine with a considerable degree of accuracy the course of cyclones across the Atlantic Ocean.

— It has been generally accepted that the translation of the name of 'Kongo' is 'the country of leopards,' the root *ko* meaning 'the country,' and *ngo* 'leopard.' J. Jankó, in the January number of *Petermann's Mitteilungen*, shows that this translation is not satisfactory, as, according to the rules of the Bantu language, these two words cannot be combined into the word 'Kongo.' He discusses the various forms of this word as found among the tribes of the Lower Kongo, — the Bakongo, who live on the river from its mouth to Stanley Pool; the Bateke, who occupy the regions between the Kuango and Kongo, and the Kongo and Alima; the Babuma, north-west of the last tribe; and the Bayanzi, between Leopold Lake and the Kongo. The Bakongo name of the river is 'Kongo,' that used by the Bateke is 'Songo,' and the Bayanzi say 'Rongo.' All these names are dialectic variations of the same word, the *k* of one dialect becoming *r* and *s* in the others. The meaning of the word in the Bayanzi dialect is 'spear,' and accordingly Jankó explains the name of Bakongo as 'the man with the spear;' the name of the river, as 'fast as a spear.' If this translation should be correct, it seems more probable that the name of the river was derived from that of the tribe. Jankó remarks incidentally that the root *ku* infers a motion, and that it is contained in the names of numerous rivers, such as Kuilu, Kunene, Kuango, Kuanza, which therefore must not be spelled Kwilu, Kwango, etc. It seems probable that the same root may be contained in the word 'Kongo,' and that the meaning 'spear,' which is, according to Jankó, confined to the Bayanzi, is also derived from this root.

— In controlling the movements of domestic animals by the voice, besides words of ordinary import, man uses a variety of peculiar terms, calls, and inarticulate sounds, — not to include whistling, — which vary in different localities. In driving yoked cattle and harnessed horses, teamsters cry 'get up,' 'click click' (tongue against teeth), 'gee,' 'haw,' 'whoa,' 'whoosh,' 'back,' etc., in English-speaking countries; 'arre,' 'arri,' 'jüh,' 'gio,' etc., in European countries. In the United States 'gee' directs the animals away from the driver, hence to the right; but in England the same term has the opposite effect, because the driver walks on the right-hand side of his team. In Virginia, mule-drivers gee the animals with the cry 'hep-yee-ee-a.' In Norfolk, England, 'whoosh-wo;' in France, 'hue' and 'huhaut;' in Germany, 'hott' and 'hotte;' in some parts of Russia 'haitä,' — serve the same purpose. To direct animals to the left, another series of terms is used. In calling cattle in the field, the following cries are used in the localities given: 'boss, boss,' 'sake, sake' (Connecticut); 'coo, coo' (Virginia); 'sook, sook,' also 'sookey' (Maryland); 'sookow' (Alabama); 'tloñ, tloñ' (Russia); and for calling horses, 'kope, kope,' (Maryland and Alabama); for calling sheep, 'konanny' (Maryland); for calling hogs, 'chee-oo-oo' (Virginia). Mr. H. Carrington Bolton is desirous of collecting words and expressions (oaths excepted) used in addressing domesticated ani-

mals in all parts of the United States and in foreign lands. In particular he seeks information as to (1) the terms used to start, hasten, haw, gee, back, and stop horses, oxen, camels, and other animals in harness; (2) terms used for calling in the field cattle, horses, mules, asses, camels, sheep, goats, swine, poultry, and other animals; (3) exclamations used in driving from the person domestic animals; (4) any expressions and inarticulate sounds used in addressing domestic animals for any purpose whatever (dogs and cats). References to information in works of travel and general literature will be very welcome. Persons willing to collect and forward the above-mentioned data will confer great obligations on Mr. Bolton. He is already indebted to many correspondents for kind replies to his appeal for the 'Counting-out Rhymes of Children,' the results of which have been published in a volume with that title (London, Elliot Stock). To indicate the value of vowels in English, please use the vowels-signs of Webster's Unabridged, and in cases of difficulty spell phonetically. All correspondence will be gratefully received, and materials used will be credited to the contributors. Address Mr. H. Carrington Bolton, University Club, New York City.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Weather-Predictions.

MR. CLAYTON'S letter on weather-predictions, in the last *Science*, furnishes a very interesting comparison. I find in the Bulletin of the New England Meteorological Society for October, 1887, Mr. Clayton's interpretation and verification by his own rules of the government predictions. These are made generally for the whole of New England, but it is to be presumed that he has made a fair estimate so as to give a comparison with his own predictions for south-east New England. He gives the Signal Service 58 per cent, and himself 85 per cent. It now appears (see *Science*, Jan. 27) that precisely the same predictions, stripped of all ambiguity and narrowed down to a definite locality (Boston), give, by an application of the same rules, 96 and 80 per cent respectively. This striking difference of 43 per cent, in the application of the same rules of verification, shows the absolute need of a fair comparison in weather-predictions, and that, too, between similar things. X.

The Snow-Snake and its Name.

AS my notes on the snow-snake were written partly to elicit information, and partly to point out an anachronism, I am glad to receive so early a reply. I objected, by implication, to the use of misleading terms for what is probably an old game. I am also aware that a Southern Iroquois nation, for over one hundred and seventy years past resident in New York, now has the snow-snake and a name for it; but I did not and do not think the Southern winters appropriate for the game. The description to which I referred was in every way erroneous, and yet was made to have an historic air. But I wished also to learn the extent to which the game was played, North and South, East and West, and it is pleasant to be assured that it "was a favorite out-door sport of the Carolinian and Virginian tribes of Iroquois." I would esteem it a personal favor if Mr. Hewitt will kindly furnish quotations descriptive of its early use south of the James River. They will be prized by me and others, having escaped our attention.

A more important question is raised by Mr. Hewitt. My orthography of the word *ka-wher-tah* needs no correction, as spelling and pronunciation were given me by living Onondagas, not taken from lifeless books. But the point, rather incorrectly stated by Mr. Hewitt, is worthy of attention. It is not the case, as he says, that the letter *r* "does not occur in the speech of the Onondagas of the present time," but it certainly has become obscure and rare. In all our early records the letter is frequent: Zeisberger employed it largely in his Onondaga dictionary; in Schoolcraft's vocabulary I think it is found only in the numerals; among the present Onondagas it occurs but sparingly in proper names and other words. Some time ago my Onondaga friend, Sa-go-na-qua-der, sent me a version of the Lord's Prayer in that language. He was not sure of his spelling, and wished me to revise it with him when next at his house. The letter in question frequently occurred, but the sound was obscure. I went over the version with him syllable by syllable, to get the exact sound, and retained the letter four times as clearly enunciated.

It is probable that some Onondagas have given up the letter altogether, while others retain it, and this would account for variations in orthography. My work for many years has been mainly on the early history and customs of the Onondagas, and notes on their language have been but incidental. I am now offered assistance by them in this, and, if I can carry out a contemplated plan will pay especial attention to the question brought up by Mr. Hewitt. Until I have more original data, it would be out of place, for me to do more than justify my present use. The point is debatable, in a sense, but will require some critical research if we are to know the exact extent which the change has reached.

W. M. BEAUCHAMP.

Baldwinsville, N. Y., Jan. 30.

The Occipito-Temporal Region in the Crania of Carnivora.

IN the Proceedings of the Academy of Natural Sciences for 1886, p. 36, I briefly described, under the name of the post-tympanic bone, an ossicle which lies over the squamosal and opisthotic bones in *Ursus*. I have since examined *Amphicyon*, *Dinictis*, and *Archælurus*. I find that the inferior surfaces of the conjoined bones above named exhibit appearances which resemble those seen in *Ursus*, and make it probable that a post-tympanic bone of larger size than the ursine ossicle was present in these genera. Apart from the bone itself, it is noteworthy that the details in the structure and proportions of the squamosal and opisthotic, as they unite to form the post-tympanic process, afford characters by which these genera can be identified.

I have also found that the species of extant *Felidæ* can also be separated by characters of the tympanic bone, especially by the shape of the tympanic ring, i.e., the part of the tympanic bone in advance of the septum. HARRISON ALLEN.

Philadelphia, Feb. 7.

Monocular versus Binocular Vision.

THERE is an interesting phenomenon which is new to the writer, and which very beautifully illustrates the prevalence of monocular over binocular localization. This explanation which we suggest may or may not be true, but it will certainly lead the way to a better comprehension of the fact in case it cannot be accepted as we explain it. We mention the phenomenon as much to ascertain whether it can be verified by others as to point the way to its explanation. It certainly has an interest in the question regarding the perception of distance and the localization of images in stereoscopic combination.

Take two circles, as in Fig. 1, and combine them by crossing the eyes in the ordinary way. We shall see, as is well known, three circles in the field of view, the central one the combined result of two images, and apparently nearer to us than the other and exterior circles, and nearer also than the sheet of paper upon which they are drawn. It is possible that to some experimenters the central circle does not seem nearer than the other two: to the writer it always does. If we combine them by fixating the eyes beyond the plane on which they are drawn, the central circle will appear larger and farther off than the other two. So much, however, is not new, but it is a necessary preliminary to the singular phenomenon which we have not noticed in any investigation of binocular vision. It is also known that the observer can place a pencil or pin point at the apparent location of the central circle, and it will seem to coincide with it, and there is no hesitation in placing it at a point between the sheet of paper and the eyes.

But now, if we take a fine piece of wire, a knife-blade, a needle, or a sharp pencil-point, such objects being used in order to get double images more easily, and place it a short distance farther off than the apparent position of the central circle while we keep the attention upon some point of the circumference of the circle, at a very short distance beyond the point of fixation the needle or piece of wire will appear double, and represents the ordinary homonymous images, which are the images localized beyond the horopter. We may increase this distance of the needle from the point of convergence, and the distance widens as usual between the images. There is perhaps nothing new in this fact. But if we keep the convergence of the eyes perfectly fixed for the combination of the two circles to form the central one, and turn the attention to the two homonymous images apparently beyond the point of convergence, and without allowing the convergence to change so as to combine the images of the needle, we shall find, by very close attention, that they will instantaneously spring into the position of heteronymous

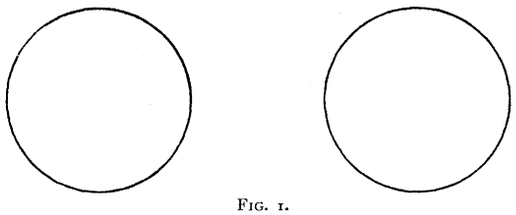


FIG. 1.

images, nearer the eyes than the circle, and without either becoming really heteronymous, or in the least approaching each other. Rivalry often takes place between the two positions, so that the images of the needle will alternately seem nearer and farther than the central circle at the point of convergence.

A beautiful way of testing the same result is to place the knife-point or needle upon the sheet of paper, and coinciding with any point in the circumference, but always allowing the length of the object to lie in, or parallel to, the vertical meridian. If the attention is fixed strongly upon the knife-blade or needle while convergence combines the two circles, the two images of the needle or blade seem to coincide with two of the circles, the central and combined circle, and one of the outer circles. But the central and combined circle seems in the same plane with the sheet of paper and the other two circles. This may vary, however, with rivalry, as experience will show. But if now we begin to move the object toward the eyes, and therefore toward the point of convergence, without altering the latter, and without changing the attention, the two images of the needle or knife-blade will appear nearer than the central circle, and also seem to approach the eyes until they reach a certain point, where they instantaneously assume the homonymous position beyond the central circle. The feeling of surprise is very marked at this sudden appearance of the images at a greater distance than they had just seemed.

If, again, we draw the circles upon a plate of glass in order to combine them by fixating beyond it, and try the experiment as we have described it, the images at first appearing beyond the central circle and homonymous, by close attention will suddenly appear in the heteronymous position, nearer than the central circle, as before. It must be remembered, however, in both cases, that the images do not become really heteronymous, as can be proved by suddenly closing and opening one of the eyes. The same image vanishes in both apparent positions of the double images. The single interesting fact, both when we combine by convergence and when we combine by fixating beyond, is that the two images of the object really beyond the point of fixation will appear at times to be nearer, and will not assume a fixed homonymous position until the attention upon them is relaxed. Now for the explanation.

It is clear that the double images of the needle or knife-blade are simply the ordinary homonymous images, and hence are localized beyond the horopter, or point of fixation. So far the phenomenon only accords with the ordinary law. The anomaly appears when their relative position is changed and they seem translocated into the heteronymous position. But if we revert to the influence of attention in all sensory processes, we may discover a cause for the effect we have described. It is known that we may so absorb our attention as to be unconscious of a severe pain in the tactual sense. Or in vision we may be so occupied with a particular object as not to notice the presence or approach of another. We may even lose entire sight of all objects except the one in which we are interested. Again, it is a universal fact that attention directed to any object in the field of view, at once and automatically sets the eyes into the proper movement for adjustment to produce single vision. At the same time the visual tension of the eyes is relaxed for the object from which the attention is turned. With these simple facts, we may turn to the experiments we have described. Here, when we keep the adjustment for combination constant, but direct the attention to the two homonymous images, the tension for binocular localization is relaxed by the change, and we are left to monocular principles for the localization of the images of the needle as well as that of the central and combined circle. The latter appears in the same plane as the sheet of paper, or approximates it in proportion to the relaxation of binocular tension, and thus introduces monocular influences into the localization of combined images, while only monocular functions are left to localize the homonymous images of the needle or knife-blade. Hence it appears as it really is; namely, nearer than the central circle. We may test whether it is due to the prevalence of monocular over binocular innervation by moving the needle far enough off to make its images coincide, or nearly coincide, with the circumference of the combined circle at the termini of the diameter, and, while they seem in the heteronymous position, suddenly close and open one of the eyes. We shall see the remaining image of the needle apparently nearer than the circle, and in the same position, without change, which it occupied before closing the other eye. The eye must be closed and opened as quickly as possible, so that the other eye will not have time to resume the parallel position, and hence there will be no apparent motion of the circles. This will enable us to determine more accurately the monocular character of the localization of the homonymous images. We see the image of the needle and the circle in the same relative positions as before closing the eye; and, since this can be only monocular, we can best suppose that the translocation we have described is due to the prevalence of monocular functions over the binocular by the withdrawal of attention from the latter.

It is a still more interesting fact that the writer has been able, by considerable practice, to localize one of the images of the needle homonymously under the circumstances described, and the other heteronymously. I have been able to alternate them to some ex-

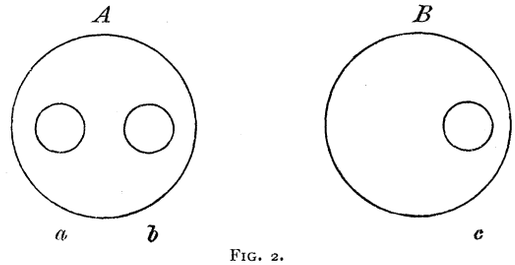


FIG. 2.

tent, although generally it is the left image that appears nearer, and the right image farther, than the point of binocular fixation. In such cases evidently one eye can keep up the binocular innervation, while the other becomes monocular in it. Astonishing and presumptuous as such a supposition may seem, it is entirely confirmed by the following second experiment, which also illustrates the rivalry between binocular and monocular functions, as in Fig. 1. Take the circles *A* and *B*, with the smaller circles *a*, *b*, and *c*, as we have drawn them, and combine them by convergence. It is plain that the fusion of *b* and *c* will take place at the same time with that of *A* and *B*. But *a* has no corresponding circle in *B* with which to fuse. If *b* were absent, the binocular effort at convergence would automatically tend to combine *a* and *c*, so that they would appear nearer than the fused image of *A* and *B* in the precise ratio of the convergence required for their combination. We have elsewhere worked out the explanation of all such localization

in accordance with the reflex innervation, if we may call it such, for adjustment. But we shall not enter upon this in our present problem. We have mainly to notice that *a* and *c* will not fuse while the latter, *c*, can fuse with *b*. Now, as no greater degree of convergence is required for the combination of *b* and *c* than for *A* and *B*, their combined image will appear in the same plane as that of *A* and *B*. This is of course relatively a monocular localization. But, singularly enough, there is a binocular effort, as it were, in one eye, to combine *a* with *c*; and the result is that *a* appears nearer the observer than the combined image of *A* and *B*, without in the least translocating the fused image of *b* and *c* from their position in the plane of *A* and *B*, and without separating them to produce any fusion of *a* and *c*, although the latter can be effected if we will. Rivalry will at times suppress the translocated image of *a*, so that it appears monocularly located in the same plane with *b* and *c*, or *A* and *B*. The alternations may be very distinctly observed. But here we have a very evident case of binocular innervation in one eye, and localization of *a* in accordance with it nearer the observer; while no such binocular translocation and innervation take place for the fused image of *b* and *c*, because it preserves a constant relation to that of *A* and *B*. *b* and *c* sustain the same relations of distance to the median plane, and hence will be monocularly localized in the same position of the third dimension as *A* and *B*, although binocularly combined. Whatever of tension or innervation there may be in the left eye for binocular combination of *c* with *a* is counteracted by the opposite tension to retain the fusion of *b* and *c*, which remains located in the plane of *A* and *B*, or, better, of their fused image. Thus there is left only the binocular innervation of the right eye to translocate the image of *a* to a position nearer the observer than the other images, except when this tension is suppressed by rivalry. Then *a* is located at the same distance as the others. The incident is interesting as showing that there may be rivalry between binocular and monocular functions for localization in the *third* dimension as well as the ordinary rivalry between colors in plane dimension. It confirms also the results of the first experiment we have described.

We have presented these phenomena to suggest the possibility that monocular influences, apparent in the instances noted, may account for many irregularities and illusions in binocular vision as practised by the experimenter to investigate localization. Why may not rivalry between them suppress certain impressions, so that the effect may appear to be different from what it really is? Why may it not account for the failure of stereoscopic combination of two real objects to translocate their fused image to the point of fixation? We do not insist that our explanation must be correct: nor will too great stress be laid upon our conjectures without some verification from the experience of others. To our experience there seems no other way of looking at the matter.

J. H. HYSLOP.

Baltimore, Md., Jan. 31.

Transcontinental Railroads.

IN treating the subject of transcontinental railways, *Science* (x. No. 241) uses language to the effect that the Cascade Range of Oregon and Washington is known to be a continuation of the Sierra Nevada, and mentioning as a striking and all-important structural difference that the Cascades are volcanic, while the Sierra is granitic, therein assuming as facts two propositions which have been much debated, but which, in the present state of geological knowledge, can hardly be demonstrated. In order to learn the progress of opinion respecting the connection of the two ranges, readers of *Science* should consult the *American Journal of Sciences*, third series, vol. vii. p. 177, wherein Prof. Joseph LeConte suggests the idea, original with himself I believe, of the unity of the two ranges in age and cause.

Second, Clarence King, in 'Geology of the 40th Parallel,' pp. 441–454, extending theory far beyond the support of adequate observation, held that the Cascades were separated in age from the older Sierra by a vast time-interval (to wit, the whole of the cretaceous period), and that the Blue Mountains of eastern Oregon were the real continuation of the Sierra.

Third, Dr. Becker of the United States Geological Survey, basing his opinion on the finding of granitic and metamorphic rocks in the cañon of the Umpqua River in the southern Cascades, remarks (see Bulletin 19, United States Geological Survey) that that portion of the range has a foundation similar to the California ranges, and is probably due to the same upheaval. He thus maintains a proper reserve as to the general question.

Lastly, Mr. Diller (Bulletin 33, United States Geological Survey), after examining the stratigraphical relations of the Cascades, Sierra, and Coast Range at their presumed point of divergence in northern California, while quoting Dr. Becker's discovery and opinion, sums up his own conclusions thus: "As far as is definitely known, the Cascade Range was not represented by a ridge of older metamorphic rocks which were folded and upheaved at the same time with the Sierra and the older portion of the Coast Range, and *is entirely distinct from them in structure and origin.*" In another connection he says, "Such rocks [granitic and metamorphic] make up the Coast Range west of Mount Shasta, and it may be that they form an elevated foundation for the Cascades between Rogue River and Mount Hood; but this is rendered less probable by the complete section along the Columbia River, where the range is cut across nearly to sea-level, showing, according to Professor LeConte, that it is made up almost wholly of recent lavas resting on undisturbed miocene strata." Mr. Diller, of his own observation, announces that the Cascades, where intersected by the Klamath River, are also composed exclusively of recent eruptive rocks. Thus the matter stands to-day, and it is doubtful if the question of a simultaneous origin is to be settled on other than paleontological grounds, by a careful and minute comparison of fossil evidences.

The second assumption, that the two ranges differ in the one being granitic, the other volcanic, I dare say, is but the reflection of the common belief which took its rise from the circumstance of the only known or visited section, that of the Columbia gorge, being entirely volcanic, but is nevertheless a most indiscriminating and erroneous opinion, as I will endeavor to show.

I find that the drift brought down by the ancient glaciers of the Cascades, and deposited in the valleys below, invariably contains a proportion, though very variable, of granitic and sedimentary bowlders. In some cases, particularly of certain ice-streams which flowed into the Willamette valley (which, by the way, is covered for the most part with glacial *débris* to a great depth), the granite and metamorphic bowlders and gravel predominate immensely; sometimes, indeed, to the exclusion of volcanic sorts. The prevailing types in most other drift localities, however, are volcanic. The significance is that a part of the rock-masses eroded by the ancient glaciers were granitic and metamorphic beyond a doubt; and, in the cases where transported bowlders prevail, the parent granitic and metamorphic rock-masses from which they were derived must have preponderated over the volcanic masses. I leave the question of the comparative erodibility of the various rock-masses, as well as the considerations arising from their relative positions, all of which must have had influence on the proportions of granitic, metamorphic, and volcanic glaciated bowlders.

But we need not depend upon the accidental evidences of extinct glacial action to prove the composition of the Cascades, for examinations of the range at different points have shown me that it is not exclusively volcanic by any means; indeed, I doubt much if the granitic and metamorphic rocks do not preponderate over the volcanic rocks, viewing the range as a whole. Judging by the evidence of formations *in situ*, I should say, notwithstanding the existence of exclusively volcanic sections, that the foundation of the range in general is not unlike that of the Sierra, excepting that I see no indication of the great orographic blocks which, according to Mr. Diller, compose the northern Sierra.

Judging from what has been published concerning the range, the prevailing idea of its structure seems to regard it as composed of a single anticlinal ridge composed wholly of basalt, and crowned with snow-covered conical peaks set at regular distances along the range. Geologists who have this idea will be surprised to learn that granite appears in the range at an altitude of two thousand feet, within eight miles of the Columbia. This is on the north side of the river; while on the south, towards Mount Hood, it is said to be found at five thousand feet. I cite only the former instance as observed by myself. I also find granite on the Santiam River at a height of five thousand feet above sea-level, and on the McKenzie

at twenty-five hundred, it forming the bed of the latter stream for twenty miles.

One of the most interesting portions of the Cascade Range is the region of the Santiam River, in latitude 44° 45′ north, — a tributary of the Willamette. The lower foot-hills there are composed of a yellowish volcanic ash, stratified in part, and which reaches a thickness of several hundred feet. Such deposits are very abundant on the western slope of the range, amply fulfilling Mr. King's acute prediction of their existence (see 'Survey of the 40th Parallel,' vol. i. p. 453). The ash rests upon basalt, which lies in thick layers conforming to the general westward slope of the range. As we advance into the mountains, the basalt thins out, and at a moderate elevation disappears entirely in its general form of surface outflows, and is seen only as scattered dikes penetrating older rocks. Undoubtedly the basalt rests, as a rule, upon the unaltered sedimentary rocks to be referred to in another connection; but I have not observed them at the precise locality of which I speak. At an altitude of perhaps one thousand feet, the later rocks are replaced in the bed of the stream by metamorphic rocks of a slaty texture, which appear to dip westward. Proceeding up stream, and approaching the axis of the range, we find in very deep cañons some excellent exposures which illustrate the geological structure in a most remarkable and cogent way. The cañons are clearly of glacial origin, and are cut down three thousand feet or more through rocks of various ages, the lowest ones visible being metamorphic slates similar in all respects to the auriferous slates of California, — a resemblance that is heightened by the fact that the Santiam slates are also auriferous, workable quartz veins existing therein. The slates are nearly vertical, with a slight westerly dip. Upon them rest unconformably a great thickness of clayey and sandy shales, and conglomerates, unaltered, and of course devoid of quartz veins, and occupying a nearly horizontal position in general. They are cut by deep cañons into great mountain-masses, and form probably the most important division of rocks at this part of the range. I should judge them to be fully two thousand feet thick, and perhaps three thousand. I have secured no fossils from which their age might be determined, but for statigraphical reasons, with which I will not trouble *Science*, I shall denote the terrane as cretaceous until its age be more satisfactorily determined. I am not aware of any description of this formation having ever been published, nor have I ever heard or read aught concerning it.

Of later sedimentary rocks, the only existing ones yet discovered are certain fossiliferous sandstones and associated shell limestones, which have been spoken of as miocene, and may well belong to that system. They appear in the Cascades as fossil sea-beaches, defining the limits of the miocene ocean. The maximum height at which I have noticed these rocks in the Santiam region is between eight hundred and a thousand feet.

As might be supposed, the metamorphic slates rest against granite, which here forms the backbone of the range, the upper central portions being entirely composed of it and slate, plus a proportion of recent lava, which seems to have come from crater eruptions, but of which I can say little. I desire to call attention to the prevalence of ancient lavas in contradistinction to the more modern basaltic flows. There are heavy bodies of probably augitic lava overlaid by and therefore older than the rocks I have denominated cretaceous. Other instances seem to prove associated lavas as old as the auriferous slates. Of these eruptive rocks, I recognize two or three general types, which I have forwarded for study and determination to Professor Jackson, the petrologist at Berkeley, Cal. Altogether, I believe that the eruptives, old and new, make up perhaps one-eighth or one-tenth of the bulk of the visible terranes of the Santiam.

It is evident that the Santiam section resembles neither the exclusively volcanic exposures cited, nor the Umpqua section, as described by Dr. Becker, who found granite and metamorphic rocks overlaid unconformably by miocene strata, without the presence of intermediate unaltered rocks. Besides, his metamorphic types were chiefly serpentine, which, notwithstanding its immense development in southern Oregon, I have not noticed north of the Calapooia Mountains. It seems not improbable that the serpentines may be the representatives of the unaltered shales and conglomerates of the Santiam.

From the above observations, and from other reasons which I will not take space to explain, I conjecture that the earliest mountain-making movement which affected the Cascades took place much farther back than the cretaceous, as held by some, and resulted in forcing up the granite nucleus, with its covering of slate or the representatives of slate, to a considerable height above sea-level; this movement being followed by extensive denudation, of which good evidence appears to exist. Then followed a submergence, total or partial, when the strata that I call cretaceous were laid down. The whole range could hardly have been ingulfed at the time, for I am told of tracts now existing where no intermediate strata are found between the early granite and the late basalt. I can suggest nothing as to the condition of affairs during the eocene time, the question of the existence of marine strata of that age in Oregon not having received attention.

It would seem that the miocene strata were deposited on rising areas, when the Cascades had reached to within a few hundred feet of their present height.

It is probable that there have been at least two upheavals, and one movement of subsidence, which, with attendant phenomena, I have grouped as follows: —

1. In paleozoic or early mesozoic time, primary elevation of granite axis with overlying sediments, accompanied by metamorphism of the latter.

1*a*. Denudation of range.

2. Subsidence beneath cretaceous sea, and deposition of cretaceous strata.

3. Elevation to within one thousand feet of present state.

3*a*. Deposition of miocene rocks.

3*b*. Outpouring of lavas through fissures.

3*c*. Era of crater eruptions, and deposition of beds of volcanic tuffs in late seas and lakes.

3*d*. Continued elevation of land to present height, accompanied by glacial and aqueous erosion. Diminished volcanic activity.

There are certain evidences, among them Captain Dutton's discovery of a rising surface at the Cascades of the Columbia, which make it probable that the mountain-making movements are still going on in the range.

HERBERT LANG.

Portland, Ore., Jan. 31.

Queries.

27. WASHINGTON'S LETTERS. — In the last number of the *Magazine of American History* there are two letters of Washington which I think are of doubtful authenticity. The first letter is printed on p. 162: the second immediately follows it. Both are claimed to be taken from originals in the collection of Dr. Thomas Addis Emmet. That forgeries are extant of Washington's letters, is well known to collectors. One prominent test of such forgeries is said to be in the autograph. Washington always abbreviated 'George' by writing 'G°,' and never used the initial *G* alone. Such a test, if reliable, applied to the letters, would prove them to be forgeries. This test will hold good in comparing the undoubtedly genuine letters copied from originals in the British Museum, and printed in the same number of the magazine. Again, the subject-matter of these letters is suspicious, especially where Washington is made to write of his troops at Cambridge, that they "are an *exceedingly dirty and nasty people*." I do not claim to be an expert on such matters. On the contrary, my disbelief in their authenticity is based more upon my wish that our beloved Washington did not write such a sentiment.

GEORGE GLENN WOOD, M.D.

Muncy, Penn., Feb. 7.

Answers.

23. DROPS OF WATER. — In answer to Mr. E. J. Pond's query in relation to floating drops of water upon the general surface (*Science*, xi. p. 38), I beg leave to refer him to the paper of Prof. Osborne Reynolds of Manchester (England), published in *Nature*, vol. xxv. p. 23, Nov. 3, 1881, where he will find an explanation of this capillary-film phenomenon, as well as a clear indication of the physical conditions necessary for its production.

JOHN LE CONTE.

Berkeley, Cal., Jan. 30.